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Experiments were conducted to discover whether instructional films in color were more effective than black and white versions of the same films. In one experiment, color and black and white versions of five instructional films were shown to 500 ninth- and tenth-grade students, half the students seeing the color films and the other half seeing the black and white. The subjects were tested immediately after the film showings and again six weeks later. When the data were analyzed, procedures were used to equate the classes. In a second experiment, conducted a year after the first, four of the five films used in the first experiment were again used. The population consisted of 199 high school students. An alternation technique was used to equate the differences in learner characteristics.

Results in both studies were essentially the same. Both types of films produced the same amount of learning. Information presented in the color films was retained longer. Color films were preferred to black and white films.

The use of color in the instructional films was not justified in terms of greater learning by the viewers. A possible limitation in the experiment was that color was not a crucial cue for learning. Such other cues in the films as shape, contrast, texture, and information in the commentary provided equally important learning cues.

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RELATIVE EFFECTIVENESS OF COLOR AND BLACK AND WHITE IN INSTRUCTIONAL FILMS

Human Engineering Report SDC 269-7-28

Under Contract N6onr-269 Research Conducted by:
With The Pennsylvania State College A. W. VanderMeer
Instructional Film Research Program
State College, Pennsylvania

June 1952

Report prepared by the Instructional Film Research Program

- -

FOR THE PENNSYLVANIA STATE COLLEGE

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OFFICE OF NAVAL RESEARCH

SPECIAL DEVICES CENTER

HUMAN ENGINEERING DIVISION

What gain in teaching effectiveness can be obtained by employing the more costly color films for training? This study reports on the contributions of color to increase learning.

Six hundred and ninety-nine students were given training by films; half saw color films and half saw identical films in black and white. Tests were given to discover differences in the learning of the two groups. Ratings on a like-dislike scale were made by the students to discover their preferences for color or black and white films.

Results:

1. Both films produced learning.
2. There was no greater learning from the color films.
3. Information presented in the color films was remembered longer.
4. Color films were liked better than black and white films.
5. Subject content had a greater effect on the liking for a film than the effect of black and white or color.

Recommendations:

Training films should be produced in black and white because the increased cost of color film is not offset by increased learning.

Project Engineer

Acting Head, Applications Research Section

Head, Program Branch

SUMMARY

Problem

What contribution does color make to learning from instructional films? Is the additional cost of color films justified by any gain in learning over that produced by black and white films? Are instructional films in color more effective than black and white versions of the same films for teaching?

To answer these questions, two experiments were carried out.

The First Experiment

In the first of the two experiments, color and black and white versions of five instructional films were used. These were shown to 500 ninth and tenth grade students at a Pennsylvania high school. Half of the students saw the color versions of the films; half saw the black and white. Tests were given immediately after the film showings and again six weeks later. Procedures were used to equate the classes in the final analysis of the data.

The results of the first experiment did not indicate any persistent superiority for color film versions over black and white. The results did suggest, however, that color contributes in reducing the rate of forgetting.

The Second Experiment

The second experiment was carried out a year after the first. Four of the five films used in the first experiment were used in the second experiment. The population consisted of 199 high school students. An alternation technique was used to equate the differences in learner characteristics.

Results, in general, confirmed those of the first experiment.

Both studies indicated that learners prefer color versions of films, but that films are liked or disliked more because of their subject content than because they are in color or black and white.

Conclusions from the Two Experiments

1. The use of color in the instructional films studied in these experiments does not seem to be justified in terms of greater learning on the part of those who view the films.

2. The contribution of color in these films seems to be related more to retention of learning than to immediate acquisition. People who see a color version of a film do not learn more than people who see a black and white version of the same film; but after six weeks, they have forgotten less.

3. Liking for a film and learning from that film are positively related. But the influence of color in determining such liking is not great enough to warrant the use of color as a means of increasing liking and thereby increasing learning.

4. Sex differences with regard to preferences for color films and learning from color films are slight.

5. The films used were selected because they appeared to make effective use of color for emphasis or because color was intrinsic to much of the subject matter being taught. However, it is possible that in these films color was not a crucial cue for learning. Apparently other cues present in the films such as shape, contrast, texture and the information in the commentary provided equally important cues for learning and color added little.

RELATIVE EFFECTIVENESS OF COLOR AND BLACK AND WHITE IN INSTRUCTIONAL FILMS

A. W. VanderMeer

The Instructional Film Research Program

INTRODUCTION

What gain in teaching effectiveness can be expected in return for the greater cost of color films? In order to answer the foregoing question it is necessary first to determine the possible contributions of color to learning. At least three important contributions might be considered:

1. Color may be an important cue in learning what the film is intended to teach; for example, a film to teach people to identify the poisonous snakes of the United States might be made in color if the color of the snakes is an important cue in identifying them.

2. Contrasting colors in graphic presentations could be used for emphasis to make certain things stand out; for example, in an animated diagram of the Frasch Process for producing sulphur the steam pipes might be colored bright blue and the pipes carrying molten sulphur might be bright orange. These contrasting colors might suggest certain characteristics of what was being shown, and they certainly should make the various parts stand out clearly.

3. Color may be pleasing to the learner, and its aesthetic appeal may have an indirect effect in promoting greater learning, even though the color itself provides neither important meaningful cues nor emphasis.

The experiments reported here were intended to measure the contributions of color in several instructional films. One or more of the foregoing three reasons for using color might logically explain why each of the films selected for this study had been produced originally as a color film.

The types of learning expected from the films and hence measured in the experimental tests were (1) conceptual or factual; e.g., learning the main rivers of the Western United States and the geographic and economic importance of each; and (2) perceptual; e.g., the identification of snakes, and the interpretation of map symbols. In addition, a measure of "aesthetic appeal," i.e., the relative degree of "liking" for each film version, was obtained.

EXPERIMENTAL DESIGN

In order to investigate the problem of the relative effect on learning of black and white and color versions of the same films, two experiments were conducted.

The first experiment: Five films in color were shown to approximately one-half of the 500 ninth and tenth grade students in science classes at Bellefonte (Pennsylvania) High School. Black and white prints of the color originals of the same five films were shown during the same time to the other half of the students in these classes. Tests were administered immediately after each film showing, and a combined test covering all five films was administered six weeks after the final film showing. The classes had been pretested before the film showings by giving them the same combined test covering all five films, and The California Test of Mental Maturity. These pretests were used as equating measures in the final analysis. In addition, a study was made of the relationship between liking for a color or a black and white film, and learning from the film.

The second experiment: An alternation technique for showing the films was used in the second experiment which was conducted nearly a year after the first experiment. Four color films and their black and white counterparts were used; these four films were selected from the five films used in the first experiment. The students were divided into six class sections of approximately forty students each, and sections were numbered from 1 through 6. Old-numbered sections saw color prints of films A and C, and black and white prints of films B and D. Even-numbered sections saw color prints of films B and D, and black and white prints of films A and C.

In this experiment tests of learning were administered immediately after each film showing but no delayed recall tests were given.

The Films

Five films were used in the first experiment: 1) Maps Are Fun, 2) How Man Made Day, 3) Rivers of the Pacific Slope, 4) Snakes, and 5) Sulphur and Its Compounds. All were approximately one reel (400 feet) in length, and were produced by Coronet Instructional Films.

Consistent with the policy of the producer, each film had been produced originally in color with a view to the later production and distribution of black and white prints from the color original. This point is important, because it indicates that the producer presumably planned his productions so that the black and white prints would approach as nearly as possible the educational effectiveness of the color originals. It is within the realm of possibility that such production planning placed limitations upon the use of color so as to make the color films less effective than they might have been made in the absence of such restrictions. On the other hand, similar restrictions might have resulted in reduced effectiveness of the black and white films.

In the second experiment the same films were used, except that Maps Are Fun was omitted, because an even number of films were required, and because this film was the least appropriate of the original five films in terms of the science curriculum in which the experiments were conducted.

The Tests

Tests of perceptual and conceptual learning were developed for each film. For the most part, four-choice objective test items were used, although a few items had three choices and about an equal number had five.

Verbal tests. The major test on each film consisted of multiple-choice items in which the learner was required to select a response in terms of completing a purely verbal statement or answering a purely verbal question.

These items were developed by a group of test-makers who viewed a given film several times. Each viewing was followed by a period of writing test items. This process was repeated through seven or eight viewings until the group was convinced that no significant element of the film presentation remained untested.

Non-verbal tests. Some films lent themselves to the use of pictures, diagrams, or samples as supplements to the verbal questions or statements. For convenience these tests will be referred to as "non-verbal" tests to distinguish them from the purely verbal tests. Three groups of these visually supplemented test items were administered as separate parts of certain film tests as follows:

1. In connection with Rivers of the Pacific Slope, an outline map of the Western United States was given each learner. Rivers on the map were numbered. The learner was asked to match the name of the river with the number which gave its location on the map. His score was the number of correct matchings.

2. In connection with Sulphur and Its Compounds, each learner was given a set of six sealed and numbered glass vials. Each vial contained either one of the two forms of sulphur or a similar-appearing substance. A multiple-choice question was made for each vial, such as:

"Vial number 1 contains:

1. Rhombic Sulphur
2. Amorphous Sulphur
3. Dry Mustard
4. Molasses
5. None of the above substances."

3. A second viewing of Snakes was followed by a test in which slide pictures of snakes were projected on a screen. Each picture was accompanied by a test item, such as:

"Slide No. 1 shows a:

1. Hog-nosed snake
2. Water moccasin
3. Rattlesnake
4. Copperhead
5. None of the above snakes"

The slides were not made directly from "frames" from the film, but were independently prepared by various scientific supply companies. Altogether, 28 pictures of 14 different snakes (not all of which appeared in the film) were used in the test. In addition, three slides of general landscapes were shown and the learners were asked to indicate which of several snakes would be likely to be found in such a place.

The same tests were used as pre-test, post test and delayed recall measures, except that the items were arranged in different orders.

Classification of test items. As test items were developed, each one was designated as measuring the effect of a specific use of color:

1. color as an important learning cue
2. color used for emphasis or to make things stand out
3. color used mainly for its aesthetic appeal; i.e., when neither of the first two uses is clearly applicable.

The validity of these distinctions among items was checked by independent viewings of films to determine the type of use to which color was put at the point or points in the films where the requisite data for the correct answering of each test item was given.

Most items relating to the use of color as a meaningful learning cue, intrinsic to what was being shown, were items involving perceptual learning. For example, one series of items required the students to view projected slides of snakes and to pick out the name of each snake from a list. However, other items were more in the nature of measurements of concept development, such as one requiring the learner to designate the type of region, (as forest, desert, etc.) through which a certain canal ran.

Test items measuring the use of color for purposes of making certain things stand out were based upon information given in scenes photographed in animation. Identifying the meaning of map symbols, locating rivers on a map, and naming the functions of the apparatus for the production of sulphuric acid are examples.

As a partial additional check of the validity of the aforementioned distinctions among test items, each item was further classified in terms of the location of the data required to respond correctly to it. That is, test items were classified as to whether the source of their correct answer was in (1) the film commentary but not the pictorial content (2) the pictorial content but not the commentary, or (3) both the commentary and pictorial content.

This classification process made it possible for each test to yield seven scores: a total score, three part scores related to various uses of color in films, and three part scores related to the source of the information (commentary, pictorial, or both) required for correct response to test items. The sum of either set of three part scores equalled the total score. Table 1 shows the make up of each test in terms of these part scores.

Measure of "liking." In order to find out whether there were differences in liking for films in general between (1) the group which was to see films in black and white and (2) the group which was to see films in color, an "index film" in color, Five Colorful Birds, was shown to both groups. The students rated on a scale the degree to which they liked this

TABLE 1

COMPOSITION OF TESTS ON LEARNING FROM COLOR AND BLACK AND WHITE FILMS

Film Test	Test Reliability*	Number of Items	Source of Items (answer appears in)			Type of use of color (color is used for)		
			Commentary Only	Pictorial Only	Both	Intrinsic Appearance	Emphasizing Parts or Places	Aesthetic Appeal
Maps Are Fun	.695	29	2	5	22	2	15	12
Snakes								
Verbal Items	.795	47	21	9	17	5	--	42
Identification of Slides	.273	31	--	--	[illegible]	31	--	--
Sulphur								
Verbal Items	.643	52	16	9	27	5	17	30
Identification of Samples in Vials	-.044	6	--	--	6	6	--	--
How Man Made Day	.612	34	18	5	11	--	3	31
Rivers of the Pacific Slope								
Verbal Items	.737	52	27	11	14	4	11	37
Location of Rivers on Map	.456	5	--	--	5	--	5	--

* According to the Kuder-Richardson Formula #21 which estimates the lower limit of reliability. Garrett, Henry "Statistics in Education and Psychology." Longmans, Green, 1949, pp. 385-386.

film. A comparison of the average ratings of the two groups showed that the two groups were substantially equal in their liking for this film (see Table 6). Subsequently, students were asked to rate each of the films they saw on a like-dislike scale, using the index film rating as a point of reference. Differences between black and white and color groups in average liking for these other films used in the experiment could, then, be attributed to the color factor.

In the second experiment, a paired comparison technique was also used to determine the extent to which color contributed to the learners' "liking" for the film. Each student compared each film version that he saw with every other film version that he saw. From these paired comparisons it was possible to compute the "average number of films which each film was liked better than" when the film was seen in color and when it was seen in black and white. Presumably the differences in these averages were related to the contribution that color made to the liking for a film.

The Procedure

The first experiment was conducted in three phases. The first phase was devoted to the administration of tests that were to be used as a basis for the equating of groups: Intelligence tests (The California Test of Mental Maturity) and pretests on the content of the films to be presented later. The same tests on film content were used as pretests, immediate recall and delayed recall measures.

The second phase of this experiment consisted of film presentations followed immediately by the administration of the "liking measure" and the tests on film content. The color and black and white versions of a given film and the related film tests were presented to randomly selected alternate class sections daily during this phase of the study. Each section viewed films and took tests at the rate of one per day for five days.

The third phase was the readministration of the informational tests six weeks later, as a measure of retention of learning from the films. The "non-verbal" tests were not repeated.

In the first experiment, the groups were equated, for each sex separately, by means of a multiple regression equation based on intelligence test scores and pre-test scores. Differences in adjusted means and critical ratios of these differences were computed.

The second experiment was completed during four consecutive class sessions. Each section saw a film and took a test each day as in the second phase of the first experiment. No delayed recall tests were administered because the requirements of the school curriculum made it difficult to schedule a free period for the administration of these tests. The non-verbal tests were not used in this experiment.

In the second experiment the scores on the four film tests were converted into standard scores. Comparisons were made between the means of combined standard scores on the four color film versions and the means of the combined standard scores on the black and white film versions for each sex group.

In this experiment, the alternation procedure eliminated the necessity for equating groups. Each class section saw black and white prints of two films, and color prints of the two remaining films. Thus, since each section contributed equally to the combined color film mean score and to the combined black and white film score, learner-differences between the two groups cancelled out.

RESULTS

First Experiment

Table 2 shows the extent to which learning took place and was retained, as measured by each of the verbal and non-verbal tests, for black and white and color groups combined.

Scores on verbal tests. Table 3 shows significance of differences on verbal tests between (1) groups which saw films in color and (2) groups which saw films in black and white. From this table we can see that on the immediate recall tests there is only one significant difference in learning and this difference favors the group which saw the color version of Properties of Sulphur over the group which saw the black and white version of the same film. Although none of the differences in mean scores on immediate recall tests based on the other films was significant, three of the four favored the black and white versions. On delayed recall tests, however, three out of the five differences were significant, and all three favor the color group.

Scores on non-verbal tests. Table 4 shows results on tests that were primarily non-verbal or, more accurately, on tests that consisted entirely of items in which a picture, sample, or diagram served as the basis for the discriminations that were considered as indicators of learning. In every case the results on these identification tests administered immediately after the film showing favored the black and white versions over the color versions. In two instances these differences were highly significant.

TABLE 2

COMBINED MEAN SCORES (BLACK AND WHITE AND COLOR) AND STANDARD DEVIATIONS ON PRE-TESTS, IMMEDIATE RECALL, AND DELAYED RECALL ON TESTS (FIRST EXPERIMENT)

Tests on Films	Number Cases	Number Items	Pre-Test Mean	Pre-Test Sigma	Immediate Recall Mean	Immediate Recall Sigma	Delayed Recall 6 weeks Mean	Delayed Recall 6 weeks Sigma
Verbal Tests								
Maps	251	29	14.5	5.09	23.9	3.58	19.5	5.65
Rivers	243	52	12.2	5.57	26.3	6.85	19.0	6.58
Sulphur	262	52	15.9	4.46	24.4	5.92	19.6	5.35
Snakes	259	47	17.4	5.13	30.0	7.00	24.7	8.34
How Man Made Day	262	34	11.7	4.00	20.3	4.49	15.4	5.44
Non-Verbal Tests								
Snake Slides	242	31	11.2	2.07	12.4	3.18	12.9	3.31
River Locations	206	5	1.78	1.43	3.02	1.37	1.97	1.54
Samples of Forms of Sulphur	302	6	----	----	1.87	1.11	----	----

TABLE 3

SIGNIFICANCE OF DIFFERENCES[1] ON VERBAL TESTS BETWEEN GROUPS WHICH SAW FILMS IN COLOR AND GROUPS WHICH SAW FILMS IN BLACK AND WHITE (FIRST EXPERIMENT)

Title of Film	N C	N BW	t-Ratios[2] Immediate Recall Tests	t-Ratios[2] Delayed Recall Tests
Maps Are Fun	114	137	-1.13	- .41
Rivers of the Pacific Slope	108	135	.69	1.28
Properties of Sulphur	112	150	1.99*	2.65**
Snakes	115	144	- .29	3.04**
How Man Made Day	117	145	- .63	2.08*

[1] Adjusted for Intelligence Quotient (California Mental Maturity) and Subject Matter Pre-Test by Analysis of Covariance.

[2] Minus sign indicates that the difference favors the black and white versions.

* Significant at the 5.0 per cent level of confidence

** Significant at the 1.0 per cent level of confidence

TABLE 4

SIGNIFICANCE OF DIFFERENCES [1] (t-RATIOS) ON NON-VERBAL TESTS BETWEEN GROUPS WHICH SAW FILMS IN COLOR VERSUS GROUPS WHICH SAW FILMS IN BLACK AND WHITE (FIRST EXPERIMENT)

Title of Test	N C	N BW	t-Ratios[2] Immediate Recall	t-Ratios[2] Delayed Recall
Identification of Snake Slides	111	131	-1.01	-.29
Identification of River Locations on Outline Map	94	112	-2.62**	.59
Identification of Meterials in Glass Vials. (Sulphur forms and distractors)	133	169	-2.67**	----

1 Differences in the case of the first two tests were adjusted for Intelligence Quotient (California Mental Maturity) and Subject Matter Pre-Test by analysis of covariance. The difference in the case of the third test was adjusted for Intelligence Quotient only.

2 Minus sign indicates that the difference favors the black and white version.

** Significant at the 1.0 per cent level.

Table 4 also shows that there were no significant differences between color and black and white film versions as measured by non-verbal tests administered six weeks after the films were shown.

In general, the results shown in Tables 2, 3, and 4 do not indicate any persistent superiority for color film versions over black and white. The results do suggest, however, that color contributes in reducing the rate of forgetting.

A number of possible explanations may be advanced for the poor showing of color on the results of the non-verbal tests. One is that the impact of color may be sufficiently strong to detract attention from other equally relevant and important learning cues. For example, the learner may be so impressed by the brilliant yellow of rhombic sulphur as he sees it in a color film that he is prone to identify any similar-appearing yellow powder as sulphur. Or, he may be so impressed by the color that he fails to perceive the texture. On the other hand the learner who sees the same film in black and white and who is merely told in the commentary that rhombic sulphur is yellow may adopt a more cautious attitude based on a greater relative emphasis on the other properties of sulphur.

A second explanation is that the color films used in this experiment may not have presented the learner with the full range of colors that are associated with the objects shown in the films. For example, only one or two specimens of each snake were shown in the film Snakes. In reality, snakes of the same species vary rather widely in color both from one specimen to the next and, for the same specimen, from one season to the next. The test slides on Snakes, as has been previously stated, were not taken from the film, but from other sources. It is possible, therefore, that a degree of negative transfer may have taken place when snakes of striking color as shown in the film were presented in the test slides as having somewhat different color.

It seems clear that while color in these films appeared to be an important cue, it was not a crucial cue, indispensable for learning. Other equally relevant cues appear to have contributed to learning to such an extent that in some cases color added little, if anything. Black and white films may be as good as color films in communicating visual learning cues related to texture, light and dark contrast, shape, and size, as well as the purely verbal cues found in the commentary. The presence of color may, in fact, operate to reduce the effectiveness of some of these cues by distracting the learner; the absence of color in black and white film may operate to increase the effectiveness of such cues by requiring more attention on the part of the learner to such cues as texture, contrast, shape and verbal descriptions.

If the material to be taught had been, for example, identification of semaphore signals, using colored flags, it might well have been that color would be needed to supply crucial cues without which the learning could not effectively take place. In such a case, presumably, a color film would have proved superior to black and white.

Second Experiment

The second experiment confirms the results of the first, namely that insignificant differences seem to exist between color and black and white films in terms of the immediate recall of facts learned from them as tested by the purely verbal tests (delayed recall tests were not given in the second experiment). Table 5 shows that the critical ratio of differences on total test scores (expressed in standard scores) between black and white and color was only .21 for females and .65 for males. Comparisons based on sub-test scores bear out this lack of consistent significant differences. Of twelve comparisons made six favor color and six favor black and white.

Table 5 shows no consistent pattern of sex differences. Females who saw color versions of films did significantly better on items answered in both audio and video and on items in which color was used to emphasize differences. Females who saw black and white versions did significantly better on items answered in the audio only. On the other hand, males who saw color versions did significantly better on items answered in the video only. With regard to items in which color was used to emphasize differences, both males and females who saw color versions of the films achieved higher mean scores than males and females who saw black and white versions. On items where color was an intrinsic learning cue, both males and females who saw black and white versions did better than those who saw color versions. This last finding is consistent with the results on non-verbal tests administered in the first experiment.

There were some significant sex differences in learning from black and white and color films. Males viewing color films scored significantly higher on test items taught by the pictures only, than did males viewing black and white films. Females learned more from the black and white films so far as items taught in the commentary only were concerned. On items taught by both pictures and commentary females who saw the color films did better than those who saw the black and white versions.

TABLE 5

MEAN STANDARD SCORES AND STANDARD DEVIATIONS ON PARTS OF TESTS BASED ON ALL FOUR MOTION PICTURES (SECOND EXPERIMENT) IMMEDIATE RECALL

	Sex	N	No. Test Items	Mean b-w	Mean color	σ b-w	σ color	r bw-c	C. R.
Score Total	Fem	107	185	99.7944	100.0374	18.1899	17.7178	.768	.205
	Males	92		96.6196	100.4022	17.7964	18.9341	.804	.650
Items Answered In Video Only	Fem	107	34	100.4299	99.7383	17.0925	15.4783	.399	- .400
	Males	92		98.0761	102.0217	15.6644	16.7008	.475	2.279*
Items Answered In Audio Only	Fem	107	82	101.5888	98.7103	15.7194	16.6346	.589	-2.027*
	Males	92		99.3152	100.0217	17.3907	17.5822	.676	.481
Items Answered in both Audio and Video	Fem	107	69	98.4579	101.8411	17.3865	16.2816	.640	2.444*
	Males	92		100.8370	99.3261	16.5208	18.0567	.600	- .933
Items Showing No Obvious Use of Color Other Than Aesthetic	Fem	107	140	100.0748	99.9065	17.4611	17.4188	.691	-1.270
	Males	92		99.5978	100.3587	17.7802	18.2516	.758	.582
Items in which Color was Used to Emphasize Differences	Fem	107	31	98.4766	101.5888	17.5561	18.2064	.444	1.707*
	Males	92		99.5000	100.2500	17.3290	18.5500	.428	.374
Items in which Color is an Intrinsic Learning Cue	Fem	107	14	101.5888	98.5794	19.6749	15.1239	.174	-1.375
	Males	92		100.6739	98.6413	17.5228	18.3875	.356	- .956

* Significant at the 5.0 per cent level

On the items in which color was used in the color films to emphasize differences (in maps and diagrams) both males and females who saw the color films did better than those who saw the black and white versions. However, this difference was significant for the females only.

Table 5 shows the number of test items related to each of the three uses of color in films. About three-fourths of the items were those in which color seemed to contribute only through aesthetic appeal. Color appears to have contributed significantly to the learning of only those items in which color was used to emphasize differences.

Summary: The second experiment confirms the results of the first experiment in that there were practically no overall significant differences in learning from black and white and color films as measured by tests administered immediately after each film showing.

Preferences for Films Related to Color and Subject Matter or Other Variables

Table 6 presents a considerable amount of evidence to support the conclusion that learners prefer color films to black and white films. In not a single one of nine comparisons did a group show a preference for black and white films. However significant differences in favor of color were found in only three comparisons.

Table 7 gives Pearson correlation coefficients between (1) the mean difference in a scale of liking for black and white and color versions of each of five motion pictures and (2) differences in learning gains as reflected in mean scores on pre-tests, immediate recall tests, and delayed recall tests based on the same five films. Roughly, these correlations represent the relationship between (1) the contribution of the color factor to total liking of a film and (2) the difference in learning gain attributable to color. Neither of the correlations is large (.31 and -.46) and they are in opposite directions. It would appear from this that there is little relationship between degree of preference for color and learning gain attributable to color.

While color as a factor contributing to the overall "liking rating" of a film does not seem to add proportionally to the learning acquired from that film, there does seem to be a definite positive relationship between the (1) extent of "liking" that a group of learners indicates for a given film and (2) the amount they learn from it.

TABLE 6

RATING OF FILMS LIKED BEST COMPARING BLACK AND WHITE AND COLOR VERSIONS

First Experiment

Film	N		Mean Scale Ratings[2] BW	Color	Sigma BW	Color	C. R.
Maps	141	185	10.91	11.54	3.42	2.26	1.86
Rivers	144	193	11.67	12.11	2.64	2.62	1.54
Sulphur	141	186	9.49	10.58	3.51	3.21	2.20**
Snakes	145	169	11.73	11.96	3.15	2.93	.67
Day	140	190	11.41	11.90	2.83	2.57	1.60
Birds[1]	148	197	12.53	12.70	2.20	2.21	.69

Second Experiment

Film	N		Mean Preference Rating BW	Color	Sigma BW	Color	C. R.
Rivers	95	77	2.44	2.91	1.14	1.13	.94
Sulphur	77	95	1.04	1.88	.06	1.16	2.40**
Snakes	77	95	1.74	3.11	1.56	1.08	2.54**
Day	95	77	1.72	2.05	1.03	.07	.98

[1] This film was actually shown in color to groups which would see only black and white versions of films subsequently, as a test of the equivalence of groups in rating this, the "index point" film.

[2] Rating on 13 point scale.

** Significant at the 1.0 per cent level of confidence.

TABLE 7

RELATIONSHIP (r) BETWEEN DIFFERENCE IN MEAN RATING IN TERMS OF "LIKING" OF BLACK AND WHITE AND COLOR VERSIONS OF FIVE MOTION PICTURES AND DIFFERENCES IN MEAN SCORES ON PRE-TESTS AND IMMEDIATE AND DELAYED RECALL TESTS BASED ON THE SAME FILMS

Difference in Mean Gain[1]	
Immediate Test Minus Pre-Test	Delayed Recall Test Minus Pre-Test
.31	-.46

[1] Based upon unadjusted means.

Sex Differences in Film Preferences Related to Color

It might be hypothesized that female film viewers would exhibit the more marked preference for color, since numerous studies on color discrimination and color vocabulary have revealed differences in favor of females. To test this hypothesis, a paired comparisons instrument to measure preferences for film versions was administered to the learners in the second experiment, and the resulting data were subject to an analysis of variance as described by Snedden.[1] Since four films were compared, it is obvious that a mean score of 2.0 for all black and white and color versions would be obtained if there were no color preferences.

Table 8 confirms that females preference for color films was more marked than males, but shows that, on the whole, sex differences with respect to color preference are not significant. Males exhibited marked preference for color in the films on sulphur and snakes, while females exhibited marked preferences for color in Rivers of the Pacific Slope and How Man Made Day. Thus, the films liked better by each sex group are greatly preferred in color, whereas the films liked less by each sex group elicit no such marked preference. It would seem, therefore, that either the subject matter of the film or some factor peculiar to the particular film is of greater affective importance than the general fact of whether it is a color film or a black and white film.

Table 9 shows that the overall difference in color preference between males and females was not significant. The films, Rivers of Pacific Slope and How Man Made Day were significantly preferred over the films, Snakes and Sulphur. This overall preference was due to the greater preference of girls for these films. Finally, while the overall differences between the sexes was not great in terms of color versus black and white, it was very great in terms of which films they preferred.

Summary: The results of the study of film preferences may be summarized as follows:

1. Learners generally prefer color films to black and white films.

2. Color as a factor in preference for a given film version does not appear to correlate highly with differences in learning attributable to color.

3. There is not much difference between males and females in overall preference for color films. Subject matter is a more important factor in preference for a film.

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[1] Snedden -- Statistical Methods, Fourth edition, 287-288.

TABLE 8

MEAN PARIED COMPARISONS RATING SCORE GIVEN BY SEX GROUPS TO FOUR COLOR FILMS WHICH HAD BEEN EXHIBITED ALSO IN BLACK AND WHITE

	Sulphur and Snakes	Rivers and How Man Made Day	All Four Films In Color
Boys	2.73	2.39	2.56
Girls	2.08	3.31	2.70
Both	2.40	2.85	2.63

TABLE 9

F-RATIOS OF DIFFERENCES IN PREFERENCES FOR COLOR FILMS BY SEX AND SUBJECT MATTER

Source of Variation	F-ratio	Level of Confidence
Males vs. females	.51	Not significant
Snakes and Sulphur vs. Rivers and How Man Made Day	5.58	5.0 per cent
Interaction between sex and film subject matter	17.38	0.1 per cent

CONCLUSIONS

The following conclusions seem to be supported by the data gathered in this study:

1. The use of color in instructional films which may superficially seem to "call for color" does not appear to be justified in terms of greater learning on the part of those who view the films. If color is to be used effectively in films there must be careful pre-production consideration of the probable psychological impact of specific uses of color upon the learner.

2. The contribution of color in films seems to be related more to the retention of learning than to the immediate acquisition of learning. Those who view color films may not learn more than those who view the same films in black and white, but they are likely to forget less of what they learn than those who view the black and white films.

3. While "liking" for a film and learning from the film are probably positively related, the influence of color in determining such liking is not great enough to warrant its use as a means of increasing liking and therewith increasing learning. The "aesthetic value" of color as a contribution to learning effectiveness appears to be less than that of the intrinsic appeal of the subject matter.

4. Sex differences with regard to preferences for and learning from color films are slight.